**Reg. No. \_\_\_\_\_\_\_\_**

**Karunya University**

**(Karunya Institute of Technology and Sciences)**

(Declared as Deemed to be University under Sec.3 of the UGC Act, 1956)

**Supplementary Examination - June 2011**

**Subject Title: ADVANCED FLUID MECHANICS AND COMPUTATIONAL FLUID**

**DYNAMICS Time: 3 hours**

**Subject Code: 10ME307 Maximum Marks: 100**

**Answer ALL questions (5 x 20 = 100 Marks)**

1. **Compulsory**:

a. Derive the Lagrangian form of Continuity equation. (7)

b. Write the unsteady state Euler’s equation and give the assumptions made. Derive the Bernoulli’s equation from it, stating the additional assumptions to be made. (8)

c. A horizontal pipe of diameter 400 mm carries water at a velocity of 25 m/s. the pressure at the points A and B are given as 29.43 N/cm² and 22.563 N/cm² respectively. Find the loss of head between A and B? (5)

2. From the first principles, derive the Energy Equation.

(OR)

3. a. Explain with a sketch the Newton’s law of viscosity. (6)

b. Classify the forces operating in a viscous fluid. (6)

c. Give the Navier Stokes relations. (8)

4. a. A point source is a point where an incompressible fluid is imagined to be created and sent out evenly in all directions. Determine its velocity potential and stream function on a plane passing through the source. (10)

b. In a 2-D flow the velocity components are u=cy and v=0. Determine its velocity potential and stream function Find the circulation about the circle x2 + y2 –2ay = 0 situated in the flow, where c is a constant and a radius of the circle. (10)

(OR)

5. a. State and explain Helmohltz’s vorticity theorems. (6)

b. Explain the concept of images in elementary potential flows. (4)

c. With a neat sketch explain the flow field of a doublet. (10)

6. a. The following stream function describes the flow about a body. Determine the equation of the body and the stagnation points. (10)

Ψ =  (θ1 - θ2) + U r sinθ

b. Derive the equation for stream lines for a flow field of liquid streaming past a fixed sphere. (10)

(OR)

7. a. What is an analytical function and explain the necessary and sufficient conditions for a function to be analytical. (14)

b. Explain the two types of mapping with neat sketch. (6)

8. Show that the following equation is hyperbolic in its behavior and explain how the solution of the equation justifies the same.



(OR)

9. Where is the alternating direct implicit method applicable? Explain the procedure.